SECTION 553
PRESTRESSED CONCRETE MEMBERS

553.01 DESCRIPTION. This work is the furnishing and placing of precast, prestressed concrete beams, slabs, piling, and other structural members.

553.02 MATERIALS.

553.02.1 Concrete. Furnish concrete meeting Section 551 requirements.

553.02.2 Reinforcing Steel. Furnish reinforcing steel meeting Subsection 711.01.1 requirements. Obtain the Engineer's written approval for reinforcing steel substitutions.

State on the fabrication drawings showing reinforcing steel details the following or similar words: "All dimensions are out-to-out".

553.02.3 Steel Rods and Bolts. Furnish rods used as dowels made from ASTM A 307 steel and bolts meeting Subsection 711.07 requirements.

553.02.4 Prestress Steel. Furnish high tensile strength steel wire meeting Subsection 711.11 requirements.

Furnish the Project Manager one certified copy of the typical load-elongation curves for all shipments of prestress steel to the fabrication plant.

Assure all prestress steel used in the work is free of rust, corrosion, dirt, oil, spatter from welding or flame cutting, kinks, bends, nicks, broken wires, or other defects.

Prestress steel is sampled under MT-111.

553.02.5 Enclosures. Use metallic enclosures, excluding aluminum, or forms using removable cores or ducts made of rubber or other approved material. Remove cores and ducts before installing the prestress steel.

Use enclosures that are mortartight and maintain their shape when subjected to loading.

Use enclosures that are 1/4-inch (6 mm) larger in internal diameter than the bar, cable, strand, or group of wires being enclosed.

Equip cores or ducts with pipes or other connections for grout injection when pressure grouting is specified.

553.02.6 Structural Steel. Furnish structural steel meeting Subsection 711.02 requirements.

553.02.7 Elastomeric Bearing Devices. Furnish elastomeric bearing devices meeting Subsection 711.14 requirements.

553.03 CONSTRUCTION REQUIREMENTS.

553.03.1 Fabrication. Fabricate all prestress concrete members using a manufacturing plant currently certified by the Prestress Concrete Institute in the category applicable to the member being fabricated.

Furnish the Project Manager a copy of the plant's current certification in the applicable category along with the fabrication drawings for the elements to be fabricated.

The fabricator may prestress by pretension or post-tensioning the member, subject to the contract requirements.

Obtain the Project Manager's written approval before changing the prestressing details.

553.03.2 Fabrication Drawings. Before casting members, submit fabrication drawings to the Project Manager for approval. Show complete details of the method, materials, and equipment proposed for use in prestressing.

Include in the fabrication drawings the following information:

1. An erection layout of the members placed in the structure or structures with each prestress member assigned a production number. Mark each completed member with an assigned number;
2. A tentative fabrication schedule;
3. The proposed mix design, including admixtures;
4. The prestress steel manufacturer's name and the applicable specifications;
5. Details of the method and sequence of stressing including the numbered or lettered layout to be followed to stress the member. Show complete details of the proposed method for tensioning the draped strands. Include in the details gauge and elongation readings for initial, intermediate, and final tensioning, as well as the deflection sequence, where applicable;
6. Complete details, including anticipated camber, tensioning forces (initial and final), and required concrete strengths (transfer and 28-day);
7. A complete detensioning procedure for the castings;
8. Details of items to be incorporated into the beam, such as chairs, inserts, hold-downs, etc., listed by source, type, size or capacity, and supplier;
9. Show all items incidental to the beams, such as bearing plates, rocker assemblies, anchor bolts, etc., if supplied by the beam fabricator;
10. All information and data required for fabrication;
11. Show the tack welding procedure's;
12. Detail the use of all external weights or hold-downs if used. If weights are not required, note it on the fabrication drawings.

Show all changes from the prestressed details in the Contract.

Submit design calculations of the system and method of production prestressing. Submit calculations on standard 8½ by 11-inch (A4 paper) paper.

Check and approve the fabrication drawings and design calculations before submitting to the Project Manager. Show the Contractor's approval on the drawings.

Furnish 4 prints each of the fabrication drawings for approval. An additional 3 or more prints of the approved drawings may be requested.

Furnish all fabrication drawings on 22 x 36-inch (A1 paper) paper with a 1½-inch (38 mm) margin on the left side and ½-inch (13 mm) margins on the other 3 sides.

Do not begin fabrication until the drawings are Department approved and available at the plant.

553.03.3 Design of Concrete Mixtures. The prestressed girder concrete must have a minimum ultimate compressive strength of 4000 psi (27.6 MPa) at transfer of prestress and 5000 psi (34.5 MPa) at 28 days. The actual required strengths are specified in the Contract.

Furnish the Project Manager a concrete mix design that will produce concrete meeting the specified compressive strengths before use. Approved changes to the mix design may be permitted during fabrication.

Use a concrete design of between 6.5 to 8.0 sacks of cement per cubic yard (350 to 450 kg per m^3) of concrete.

Establish the Class "Pre" concrete slump range between 1-inch (25 mm) and 4 1/2-inches (115 mm). The high and low limits of the range cannot exceed 1 1/2-inches (38 mm). The range may be changed with the Engineer's approval.

553.03.4 Forms. Use steel side and bottom forms. End bulkhead forms may be steel or plywood.

Form joints and strand exits through bulkhead forms that are mortartight.

Check the grade and alignment of side forms before casting. Check the beam bed alignment for displacement while placing the concrete.

Construct beam bed forms to limit movement to not exceed 1/4-inch (6 mm) from a straight line in any 50 foot (15.25 m) length of the bed.

Use clean forms that are free from warp, bulge, and other defects.

Do not exceed a maximum offset of 1/16-inch (2 mm) where form sections are joined.

Treat the form facing with a bond breaker before each casting. Form treating materials that stain or react with concrete are not permitted. Apply form oil or other bond breaker materials without contaminating the prestress strand and reinforcing steel. Clean soiled strand or reinforcing with a non-contaminating solvent.

Chamfer all exposed concrete edges, excluding the beam top, with an enclosed angle less than 120 degrees. Use chamfer strips having no irregularities, and maintain smooth joints with the chamfer tightly fitted against abutting forms.

Fit forms with a grade strip or other positive control to establish the nominal depth of the beam.

Use forms that can be removed from the member without damaging the concrete.

Identify production form dimensions that vary from the Contract beam dimensions on the fabrication drawings.

553.03.5 Placing Reinforcing Steel. Place and secure all reinforcing steel as shown on the plans before placing concrete.

Fasten all bars at all intersections with adjacent bars.

Do not tack weld reinforcing steel if the reinforcing bar is a stress-carrying member. Welding non-stress reinforcing bars may be permitted with the Engineer's approval. Reinforcing steel welds not shown on the approved tacking detail or fabrication drawings are prohibited.

For convenience, additional reinforcing steel may be tied in for securing inserts, void ducts, etc., or may be secured by tack welding.

Protect the tensioning strand from weld spatter using wet burlap or other protective covering. Replace all strands with weld spatter at Contractor expense.

Provide the distance between the reinforcing and side forms using approved stays, ties, or chairs. Do not use precast mortar blocks, pebbles, pieces of broken stone or brick, metal pipe, or wooden blocks.

Provide clearance between the beam stirrups and the beam bed using metal chair supports with stainless steel or other approved, corrosion-resistant legs.

Use reinforcing steel in the ends of prestressed beams to provide clearance for the paving notch blockout, void ducts, embed plates and anchorages, and inserts without interfering with the reinforcement spacing.

Reinforcement in the prestressed member will be inspected in place and approved by the Inspector before the concrete is placed. Concrete placed before inspection may be rejected.

553.03.6 Prestressing Equipment. Use approved jacking equipment for prestressing.

Equip hydraulic jacks with pressure gauges. Have a certified testing laboratory calibrate each jack and gauge combination as a unit with the cylinder extension in the approximate position that it will be in at the final jacking force. Have a certified calibration chart for each jack.

Other types of jacks may be used with proving rings or other approved devices calibrated by a qualified testing laboratory.

Calibrate jacking equipment once each year and after each repair. Re-calibration may be required if any jack or gauge gives erratic results or if the difference between the gauge reading and elongations exceed allowable limits.

Equip tensioning systems with hydraulic gauges that prevent the gauge pointer from fluctuating until the jacking load is released from the tendon. The gauge must read loads directly in pounds (Newtons) or have a chart to convert the dial reading into pounds (Newtons). Assure the gauge readings are accurate to within plus or minus 2 percent.

Locate the gauges to provide the operator and Inspector a clear view of elongation measurements and gauge readings. Use gauge dials graduated in increments not exceeding 100 pounds (700 kPa) pressure. The gauge range or load cells must not use the lower 10% of the manufacturer's rated capacity in determining the jacking stress, unless calibration data establishes accuracy within the 2% requirement at the lower range.

Assure the end anchorages and prestressed member stressing blocks can maintain the required tension in all prestressed tendons until the concrete has been placed and reached transfer strength. Equip the end anchorages and stressing blocks to detect deflection while prestressing. Checks for deflection will be made by the Inspector.

Provide the equipment to determine concrete compressive strengths at the location the prestressed members are manufactured. The test equipment may be mechanical or hydraulic, capable of applying and measuring the required load. Error for loads within the loading range of the test equipment cannot exceed an error of plus or minus 1.5%. Have a certified calibration diagram covering the entire use range with the equipment at all times. The indicated load of the testing equipment

will not have to be corrected by calculation or by the calibration diagram to obtain values when the values are within the required variation of ±1.5 percent.

Certify the concrete strength testing equipment every 2 years; after each repair or adjustment of the equipment; when a non-portable machine has been moved; and whenever accuracy is in question.

553.03.7 Pretensioning. Hold the prestressing elements in position using jacks when stressing. Keep a record of the jacking force and the elongations.

Multiple units may be cast in a continuous line and stressed at one time. Leave a space between the ends of the units to permit cutting of the strands.

Furnish strand in coils, reel-less packs, or on reels. Stringing may be performed by pulling single or multiple strands. Pull to gradually relieve strand rotation on coil or reel-less packs.

Strand with gripped points are not permitted within the lengths to be stressed.

Bring all prestress tendons to the uniform initial tension on the approved fabrication drawings. Initial tension is the minimum force required to equalize stresses and eliminate slack in the strand. Submit alternate initial loading proposals to the Project Manager for approval.

The initial load may be applied by the jack used for single strand tensioning or by any other approved method that provides a definite, uniform load. Regardless of the method used, measure the initial load within plus or minus 100 pounds (450 N). Compute elongation measurements for initial tensioning but do not use as a measurement of the initial force.

Once initial tensioning is complete, reference mark the strand as directed. The mark must provide an accurate measurement of elongation by final tensioning.

Measure the induced stress by gauge and check it by elongation, load cell, or both. The results must agree within 5%. Do not permit jacking stress to exceed 75% of the specified minimum ultimate tensile strength of the prestressing steel. Measure the strand elongation to within 1% of the theoretical elongation or 1/8-inch (3 mm), whichever is smaller. If a discrepancy between measured elongations and gauge readings exceeds 5%, check and correct the entire operation before proceeding with the work.

All uplift devices, hold-down devices, and strand openings in end bulkheads must have rounded, smooth surfaces at all contact points with the strand.

Take gauge readings, elongation measurements, and make calculations for elongation and include allowances for operational losses for the tensioning system used. These allowances must include losses for strand slippage, anchor movement, friction, strand rotation, and other forces acting on the strand.

If the temperature difference between the strand at the time of tensioning and the concrete at the time of pouring exceeds 30 °F (16 °C), correct the computed elongation measurements for the temperature differences.

Provide copies of the elongation calculations to fabrication and inspection personnel at the beginning of production to insure all allowances for the method of tensioning have been considered.

553.03.8 Final Tensioning.

A. Single Strand Tensioning. After the initial load is applied and the reference marks are established, individually pull the strands to the final load. Tension each strand to the load required by the gauge reading.

The elongation measurement must be within plus or minus 5% of the load indicated by the gauge reading. If the load indicated by gauge reading doesn't agree with the measured elongation within the required tolerance, discontinue tensioning and inspect the bed for restrictions that could affect the accuracy of the applied load.

If the measurements agree, 3 more strands may be tensioned. If elongation measurement and gauge readings are within the required tolerance, the remaining strands may be tensioned.

As some variation in the modulus of elasticity and the cross-sectional area of a strand does exist, the strand tensioning may be accepted, if the difference between the load determined by elongation and that indicated by the gauge does not exceed 5%. A maximum 10% of the total number of straight strands for any one line of casting will be accepted on this basis.

If the difference between the elongation load and gauge readings exceed the limits, discontinue tensioning and correct the problem.

B. Multiple Strand Tensioning. Mark each strand, once pre-loaded and seated in the anchorage, at both end anchorages to determine elongation and slippage. The Inspector will establish references to verify parallel movement.

Measure the stressing force by the gauge system and check it by the elongation measurement.

Use two load cells to verify the applied design load and check the uniformity of pull. Place one load cell on each side of the line of pull, preferably on the outermost strands of an upper row of straight strands.

If the hydraulic gauge and the load cells agree with the elongation measurements within plus or minus 5%, the strands are acceptably tensioned. If the gauge reading is within 5% but either or both of the load cells exceed that limit, re-tension the strands including pre-loading. Locate and place the load cells on the strands nearest to those previously gauged.

If, upon re-tensioning, the load cells are within the 5% tolerance, no excess strand slippage has occurred, and the movable anchorage has traveled the required distance, the tensioning may be accepted.

If the difference between the gauge readings, load cell readings, and elongation measurements exceed the tolerance limit, stop tensioning and correct the problem.

Lubricate the jacking ram or rams, guide rods, and movable anchorage rails to minimize friction and run the ram through its length of travel at least 4 times before tensioning the strand.

C. Tensioning Draped Strands. Draped, pre-tensioned strands may be tensioned by partial jacking at the stressing block and subsequent depressing or uplifting to the deflected position or by tensioning to the initial and final loads with the tendons held in the final design position using pins, rollers, or other devices. Use low-friction devices at all points of slope change of the draped strand.

When draped strands are partially tensioned in the straight condition and then depressed to the final design position, determination of the final load is made as follows:

Before starting the tensioning operation, place a load cell at the dead end anchorage on one of the strands to be deflected in each line of beams. The Inspector will select the strand to which the load cell will be placed. Once tensioning is complete, the load cell reading must be within plus or minus 6% of the final design load.

Should the load cell reading exceed the allowable tolerance, use additional deflecting jacks to distribute friction and restraint at the deflection points or, if necessary, revise the entire method for applying the final design load within tolerances.

If the tensioning of draped strands indicates readings within the tolerances, the Inspector may require load cells for occasional checks.

If tensioning of the draped strands is performed by partial tensioning and uplift or, by tensioning in the draped position, submit the method for approval before use.

Strand splicing using approved devices is permitted. One splice is allowed on any one strand between anchorages. Splices must not fall within a beam. For single strand tensioning, the number of strands spliced is not restricted. When multiple strand tensioning is used, the number of strands spliced cannot not exceed 10% of the total number of strands in the casting line or all the strands must be spliced.

Use only one manufacturer's strand in any one tensioning operation.

Use the same direction of twist of strand wires in all spliced strands.

One wire failure in 7 wire strands may remain in the casting, subject to the following:

For beams with:

Less than 20 strands, no wire breaks permitted.
20 to 39 strands, 1 wire break permitted.
40 to 59 strands, 2 wire breaks permitted.
60 or more strands, 3 wire breaks permitted.

Should wire breaks exceed these limits, or more than 1 wire break in any individual strand, remove and replace that strand or strands.

Locate all wire breaks allowed to remain in the casting, and securely wrap the broken ends with tie wire to prevent unraveling.

The Fabricator may be ordered to check the prestressing steel in a tensioned member for loss of prestress before placing concrete. The Engineer will approve the checking method for loss of prestress. Re-tension all strands showing a loss of prestress exceeding 3% of the original computed jacking stress.

Except as permitted in Subsection 553.03.5, do not weld, flame-cut, or ground welding equipment to the bed or forms after the prestress strand has been tensioned.

553.03.9 Placing Concrete.

A. General. Batch and mix concrete under Subsection 551.03.3, except as provided below:

1. Provide master batch sheets to the Project Manager for review before production;
2. A timing device that locks the discharge gates of a stationary mixer is not required, however, the mixer must not be emptied until the materials have been mixed the specified time;
3. Ready-mix delivery slips are not required unless specifically requested.

The batching operation and equipment may be inspected at any time. The work will be stopped for failure to use approved procedures or equipment.

B. Method and Manner. Place concrete meeting Subsection 552.03.5 requirements and the following:

Obtain the Project Manager's approval before placing concrete in large members. Concrete may be placed in the member in a single lift if satisfactory results are obtained, or in multiple horizontal lifts provided cold joints are not formed. Remove and replace concrete containing cold joints. When concrete is placed in layers, place the first lift to fill the form slightly above the juncture of the bottom flange and the beam web.

Compact the concrete immediately after pouring with high-frequency mechanical vibrators operating at a minimum 4500 impulses per minute. Apply vibration internally, externally, or a combination of both methods to flush the mortar to the surface of the forms. Vibrate succeeding concrete layers to extend into the previously placed layer. Use vibrators to thoroughly consolidate the concrete to a plastic mass without causing segregation. Do not permit vibrator heads to contact reinforcing steel, prestressing steel, or other embedded items to aid consolidation. Slowly insert and remove internal vibrators from the concrete.

Have one additional vibrator available at the site at all times during concrete pours.

C. Concreting In Adverse Weather Conditions. Perform concrete work meeting Subsections 552.03.9(A) and (B) when the ambient air temperature falls below 40 °F (4 °C), except that the placement temperature for steam-cured Class "Pre" concrete must be between 50 °F (10 °C) and 90 °F (32 °C) at placement.

When the ambient temperature before concrete is placed is 35 °F (2 °C) or less, pre-heat forms to a minimum 50 °F (10 °C) removing all frost, snow, and ice from the forms and components to be embedded in the concrete.

Do not permit the concrete temperature to exceed 90 °F (32°C).

Cover open buckets of concrete with wet burlap mats or other approved coverings, when necessary, to prevent slump loss or premature drying.

553.03.10 Curing. Water-cure prestressed concrete members meeting Subsection 551.03.6(A) or steam-cure as specified below.

Protect water-cured concrete meeting Subsection 552.03.9© requirements.

Perform elevated-temperature steam process cure meeting the following requirements.

Completely enclose or cover casting beds for steam-cured members using curing blankets or other approved flexible coverings. Provide a minimum 6-inches (155 mm) of free air space between the enclosure or coverings and all concrete surfaces.

Secure flexible coverings to prevent moisture loss. Provide moisture before the cure cycle to aid hydration and prevent surface cracks caused by rapid water loss from the concrete.

Steam may be introduced before starting the cure cycle if the enclosure temperatures are maintained between 50 °F (10 °C) and 70 °F (21 °C). Fog-spray or cover the top surfaces of the members with wet blankets within 15 minutes after placing concrete to prevent moisture loss for a 3 hour period before the cure cycle.

Begin the steam-cure cycle after the concrete has been in place at least 3 hours. Maintain steam at 100 percent relative humidity, applied so it does not damage the surface of the concrete, forms, or tendons.

Raise the ambient temperature within the enclosures no faster than 40 °F (22 °C) per hour to a maximum temperature between 140 °F (60 °C) and 160 °F (71 °C). Maintain the temperature until the concrete has reached strength for transfer of prestress.

Once the cure cycle is complete, cool the beams by decreasing the temperature within the enclosures no faster than 40 °F (22 °C) per hour until the temperature difference between the inside and outside air is within 25 °F (14 °C), unless otherwise approved.

Keep a curing time-temperature record for each concrete pour in the casting bed. Provide one automatic temperature-recording thermometer for each 200 feet (61 m), or fraction thereof, of continuous bed length used. Record curing temperatures continuously for the full curing cycle. Place the temperature sensors at approved locations. Supplement automatic recording thermometers with standard bulb-type thermometers placed at approved locations. Certify the accuracy of automatic recorders once each year or when the recorder accuracy is in question. Steam curing is not permitted without automatic recorders.

The sideforms may be removed at the Contractor's discretion. Assume all responsibility removing forms before breaking the release cylinders. Concrete members damaged from early form removal will be rejected.

The cure cycle may be interrupted a maximum 20 minutes for form removal.

Do not expose members to below-freezing temperatures within 6 days of casting. In place of the 6 day requirement, the cure time may be based on the concrete strength. The concrete strength is determined by the average strengths of 3 standard 6 x 12-inch (152 X 305 mm) cylinders cast from different batches of concrete used in each round of beam castings. Expose these cylinders to the same cure and temperature conditions as the prestressed members. Immediately test the cylinders under AASHTO T22 without further curing, once removed from the cure area.

Curing may be discontinued if the average strengths of the 3 cylinders equals or exceeds the strengths specified in Subsection 551.03.7(C)(2). Should all cylinders fail, protect the member from freezing temperatures for the 6-day period. Cool all members as specified in this Subsection.

Cast compression cylinders for field tests of the 28-day strengths following MT-101. Cast the number of test cylinders as required in Subsection 551.03.7(A)(2) and MT-111.

The Contractor may submit in writing, alternate curing methods, for approval.

553.03.11 Transfer of Prestress. Prestressed strands may be released when the concrete has:

1. Reached the minimum compressive strength for transfer of prestress;
2. The cure cycle is complete;
3. Restrictive forms are remove.

If delays are anticipated, maintain the temperature in the curing enclosure at a minimum 50 °F (10 °C) until transfer of prestress.

Use positive, external hold-downs or weights to offset the uplifting forces in the member when the hold-down strands are released, when required.

Use a method of harped and straight strands release to hold the lateral eccentricity of prestress to a minimum. Detail the bed release and the strand-cutting pattern on the fabrication drawings. Changes to the release procedures shown on the approved drawings are not permitted except by written request and the Engineer's written approval.

Cast cylinders to determine prestressed transfer strengths using MT-101 and MT-111 as modified below:

> Cast and cure the release cylinders under the exact conditions the prestressed members were cured. The concrete sample for each cylinder will be selected at random from different batches.

Once the cure cycle is complete, test the release cylinders under AASHTO T 22. Test three cylinders to determine the prestressed transfer strengths for each round of beam castings. The average strengths of the three cylinders must equal or exceed **F'r + 0.35S.**

Where:

S = the standard deviation of the strengths for the three cylinders
F'r = the required concrete transfer strength as specified in the Contract

Test all 3 cylinders within 30 minutes.

Furnish the number of release cylinders required to perform these tests.

The Contractor may cast additional back-up test cylinders.

Should the release strengths not be reached and all back-up cylinders are broken, put the casting through at least one additional complete cure cycle. The Engineer may direct other tests to determine release strengths.

Test compression specimens using AASHTO T 22. While testing, apply the last one-half of the load at a rate between 1200 to 3000 psi (8.28 to 20.7 MPa) per minute.

The Inspector will witness the Fabricator's casting and testing of release cylinders.

553.03.12 Post-Tensioning. Begin tensioning of the prestress reinforcing steel when the concrete cylinders representing the member to be prestressed reach the compressive strength shown on the approved fabrication drawings.

Stress the prestress reinforcing steel, using jacks, to the specified tension with the stress transferred to the end anchorage.

Measure the tension and elongation at all times.

Make a record of gauge pressures and elongation while post tensioning and submit it to the Project Manager for review.

553.03.13 Bonding Steel. Bond post-tensioned steel to the concrete unless otherwise specified.

Clean all dirt, loose rust, grease, or other deleterious material from all pre-stress reinforcing steel.

Flush all conduits with water and blow them out with compressed air after post-tensioning.

Remove rubber sheaths used as enclosures, then flush and blow out the voids as described above.

Once cleaned, pressure-grout the conduit or void using a pressure not exceeding 100 psi (690 kPa). Continue grouting until a steady flow of grout exits from the pipe outlet. Close the outlet, then the inlet with the grout under pressure . Maintain the final grout pressure at between 50 to 100 psi (345 to 690 kPa).

553.03.14 Concrete Surface Finish. Perform the concrete finish work immediately after de-tensioning. Give the exterior surfaces of exterior members and the entire bottom flange of all girders to the juncture with the beam web an Ordinary Finish as specified in Subsection 552.03.12(A).

All other beam surfaces may be left with the surface created by the forms, if the surfaces are true, even, and free of stone pockets, depressions, or surface projections. Point with mortar and strike off even with the surrounding surface, all air holes in the concrete measuring ½-inch (13 mm) or more in any direction. Repair rough, uneven, and non-uniform concrete surfaces using power grinders, carborundum stones, brushhammers, or other approved equipment and then apply an Ordinary Finish.

Match the appearance of the surface adjacent to the repair. Apply an Ordinary Finish to the entire adjoining surface of the member if a match is not possible.

Repair rock pockets identified for repair. Chip rock pockets back to sound concrete, clean, and permit inspection before patching. Rock pockets affecting the members strength will be further evaluated before repair.

Notify the Inspector of all members having the prestress strand exposed for 8-inches (205 mm) or more on any one strand or any exposure of multiple strands before repair.

Provide an Ordinary Finish on beam ends not embedded in concrete. The Contractor may use approved epoxy or quick-setting grout products, provided the colors blend with the surrounding surface. Before finishing the beam ends, cut the strands back a minimum of ½-inch (13 mm) and fill the depressions with an approved epoxy.

When beam ends will be embedded in concrete, the ends may be left rough and strands cut back to extend a maximum 1-inch (25 mm) beyond the surface of the concrete. Cut the strands in the area of the paving notch flush with the concrete surface.

Screed and rough-float the top surface of prestressed girders to the required depth of the member, bringing grout to the surface, and covering all aggregate.

Clean all projecting reinforcing stirrups of mortar and other foreign materials before starting the cure cycle.

553.03.15 Workmanship and Tolerances. All tolerances are applied to the theoretical positions and dimensions shown on the plans and approved fabrication drawings.

The tolerances listed in Table 553-1 are the total allowable tolerance accepted in the finished product. Tolerances in other manufacturing sequences cannot accumulate to supersede any individual tolerance. Members having dimensions outside the tolerance limits may be rejected.